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# Is the environment a luxury? An empirical investigation using revealed preferences and household production



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### ABSTRACT

This paper combines demand analysis with household production to estimate the marginal willingness to pay for improvements in air quality in Italy and the corresponding income elasticity of willingness to pay. We use choice based data on Italian households' current consumption expenditures from January 1999 to December 2006 merged with an air quality index. We consistently find that the income elasticity of willingness to pay for environmental quality is very close to one across income groups. Besides contributing to a strand of literature where there is scant empirical evidence, we provide the first attempt at implementing the theoretical approach suggested by Ebert (2007), which derives willingness to pay and its income elasticity using revealed preferences combined with household production.

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## 1. Introduction

The objective of this paper is to estimate the willingness to pay (WTP) and the income elasticity of WTP for improvements in air quality in Italy using a new methodological approach, proposed by Ebert (2007), and a new data set.

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The methodology applied in this paper (Ebert, 2007) is based on the following assumptions: (i) a complete (conditional) demand system for market goods, which may depend on environmental goods, can be observed; (ii) a household production function, combining market and environmental goods according to a given technology, is known; (iii) the environmental goods considered do not enter the utility function directly. Using these assumptions, Ebert shows that one can derive the marginal willingness to pay functions for the non market goods which augment the conditional demand system. Then one has to investigate the integrability of the mixed demand system consisting of the demand functions for market goods and the inverse demand functions for the non market goods. If the integrability conditions are satisfied, a unique preference ordering can be recovered with the possibility of performing welfare analysis and of estimating important derived parameters, like the income elasticity of willingness to pay.

To implement this approach we consider household production of the internal level of air quality chosen by the households and assume that they combine a market good, air conditioning, with a non market good, the level of external air quality, according to a given technology to produce the desired level of internal air quality. Since the household production function implicitly describes the marginal rate of substitution between air quality and air conditioning, we can compute the marginal willingness to pay for marginal improvements in air quality. We thus estimate a complete conditional demand system for market goods augmented by the WTP function for improvements in air quality. The data set we use is obtained by merging data on Italian households monthly current expenditure and unique information on a bundle of air pollutants concentrations. We show that the resulting (mixed) demand system is integrable and we compute the marginal willingness to pay for a marginal increase in the index of air quality and the corresponding income elasticity of WTP. Besides contributing to a strand of literature where there is surprisingly little empirical evidence, this is the first attempt at implementing the approach developed by Ebert (2007), using demand analysis combined with household production to estimate WTP for a non market good.

We find an income elasticity of WTP not significantly different from one across income groups. Our findings have relevant policy implications. Growth in income and in environmental quality could be decoupled as higher income groups would not show stronger preferences for environmental quality than lower income groups do. The income elasticity of WTP is also likely to influence cost-benefit analyses, because ignoring the real incidence of social projects may produce decisions that are “biased” against the poor.<sup>1</sup> Moreover, the income elasticity of WTP for environmental benefits is important for shaping efficient environmental policies. Chichilnisky and Heal (1994) show that, in international agreements for curbing carbon-dioxide emissions, poorer countries should be allocated larger shares of the total number of emissions’ rights at an efficient allocation, if the income elasticity of WTP is between zero and one. Finally, the political appeal of environmental policies would be increased rather than limited, since income groups would benefit from environmental improvements in a proportional way.

The remainder of the paper is structured as follows. Section 2 reviews the literature on the methods for estimating the demand for non market goods and on the measures of incidence of environmental benefits. Section 3 introduces the methodology based on revealed preferences and household production. The specification of the demand system, the estimation strategy, the data, and the results are presented in Sections 4 and 5. Section 6 concludes.

## 2. Demand for non market goods and measures of benefits incidence

Researchers face two main problems when trying to evaluate environmental goods: first these goods are not traded in markets, therefore it is not possible to observe prices. Second, even though prices were observable, they might not reflect the consumer’s marginal willingness to pay because

<sup>1</sup> Given the use of the Hicks-Kaldor compensation criterion, a project resulting in a regressive distribution of environmental benefits is less likely to pass than a project that would primarily benefit high income groups. This is because the social profitability of the project is decided by the sum of WTPs and rich people have a higher WTP than poor people (Hökby and Söderqvist, 2003). Therefore, the finding that environmental benefits are regressively distributed suggests the need to use appropriate weights taking into account the distribution of costs and benefits of projects.

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